(12) UK Patent Application (19) GB (11) 2 368 050 (13) A

(43) Date of A Publication 24.04.2002

(21) Application No 0025699.0

(22) Date of Filing 19.10.2000

(71) Applicant(s)
Autoliv Development AB
(Incorporated in Sweden)
Patent Department Sweden, S-447 83 Vargarda, Sweden

(72) Inventor(s)
Antione Rouiller
Olivier Bouley

(74) Agent and/or Address for Service
Forrester Ketley & Co
Forrester House, 52 Bounds Green Road, LONDON, N11 2EY, United Kingdom

(51) INT CL[7]
B60R 21/18

(52) UK CL (Edition T)
B7B BVRQ

(56) Documents Cited
WO 98/55344 A1

(58) Field of Search
UK CL (Edition S) B7B BSBCC BSBCR BVRA BVRQ BVRR
INT CL[7] B60R 21/18 22/12 22/28
ONLINE: WPI, EPODOC, JAPIO

(54) Abstract Title
Vehicle occupant lap belt and air bag

(57) A safety device for a vehicle seat comprises a lap belt 2, which may be part of a three point harness (see figure 2) or may be solely a lap belt as shown, having a folded inflatable air bag 7 secured to one end thereof. On inflation the air bag will expand towards the buckle end 5 of the lap belt beyond the location of the air bag when folded (see figures 20 to 22). The length and location of the folded air bag is such that the folded air bag will not engage means located at the other end of the lap belt for releasably connecting to the buckle 5 even when the lap belt is buckled and extends substantially tightly across the occupant less seat. The air bag may be folded in a particularly defined manner (see figures 4 to 16).

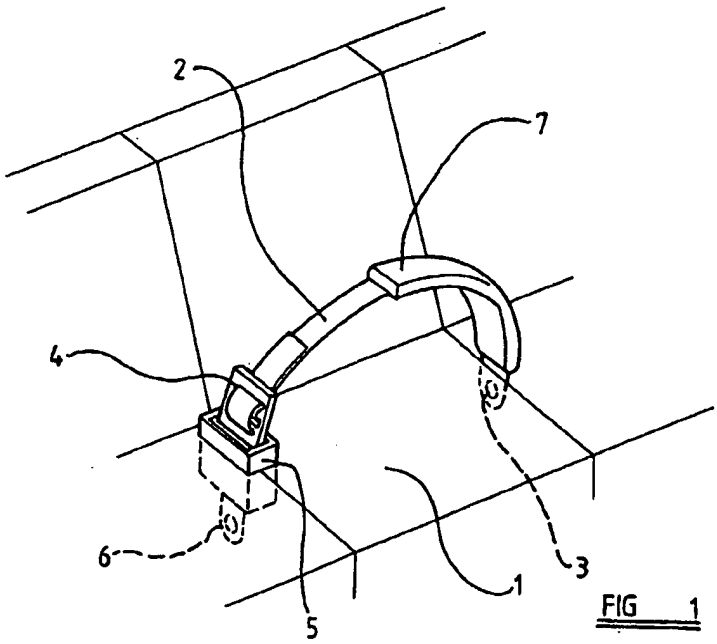


FIG 1

GB 2 368 050 A

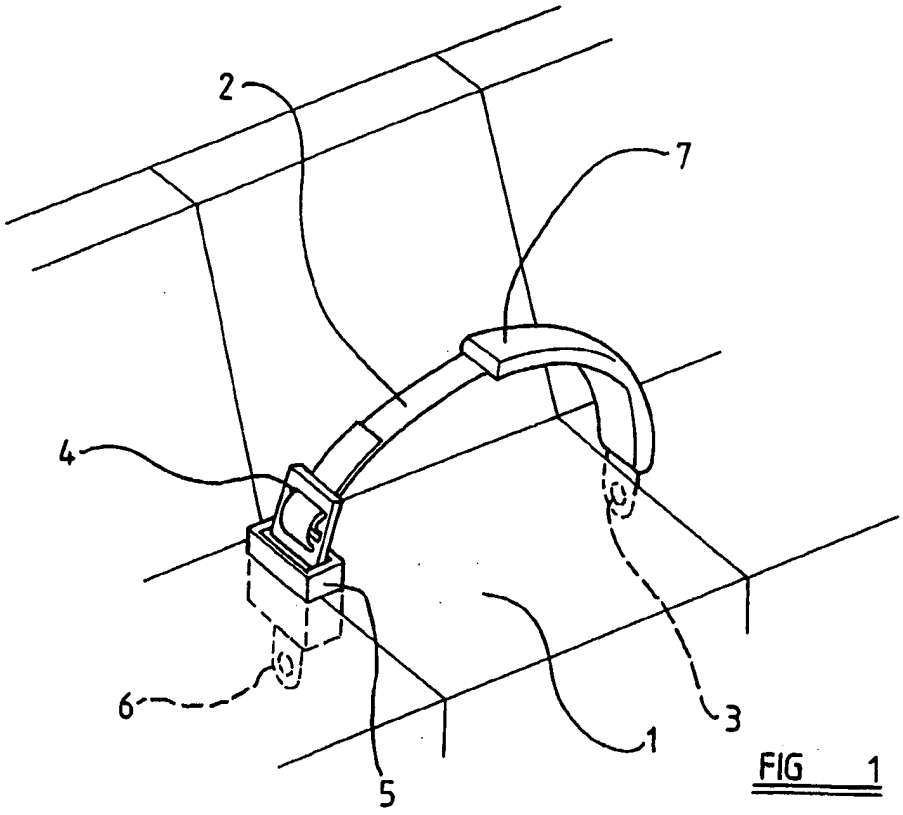
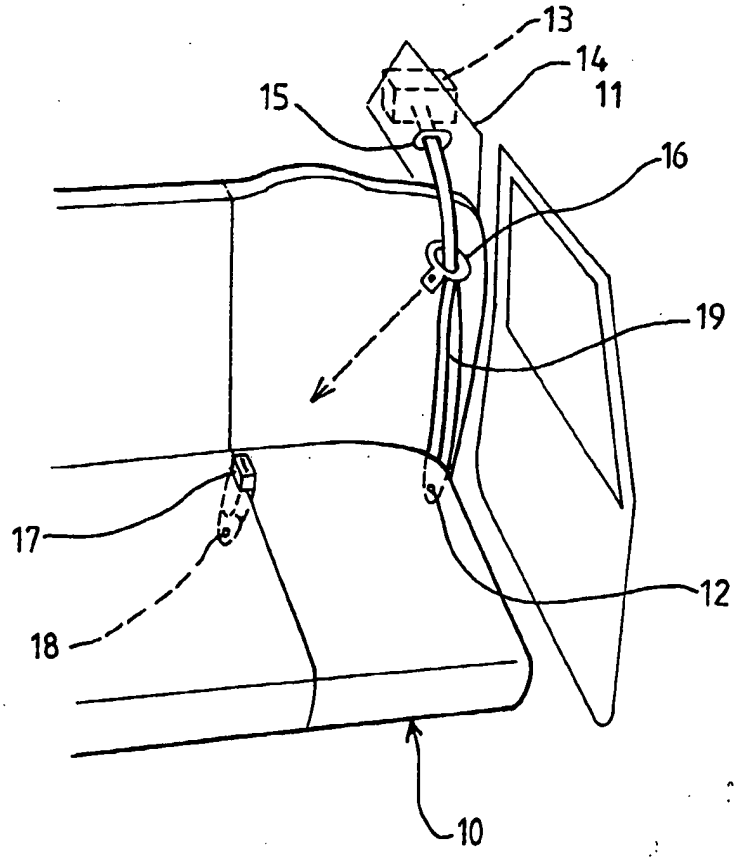


FIG 1



FIG

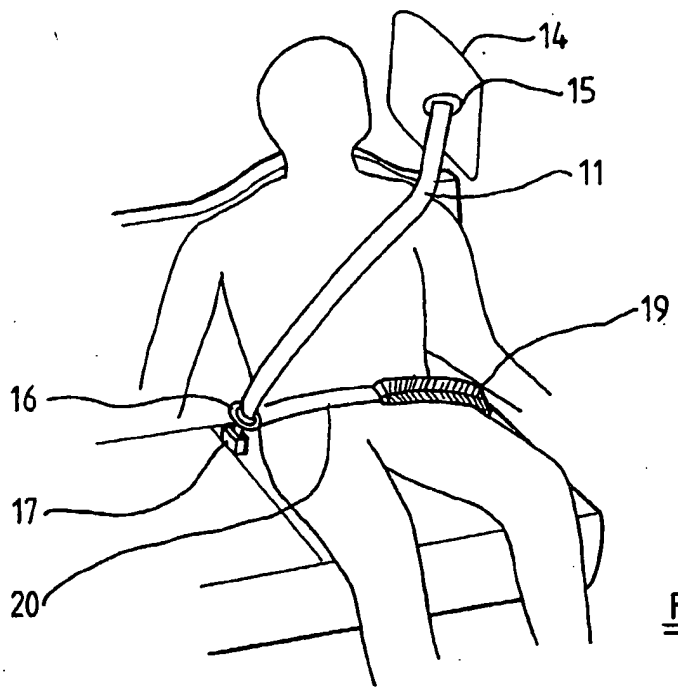
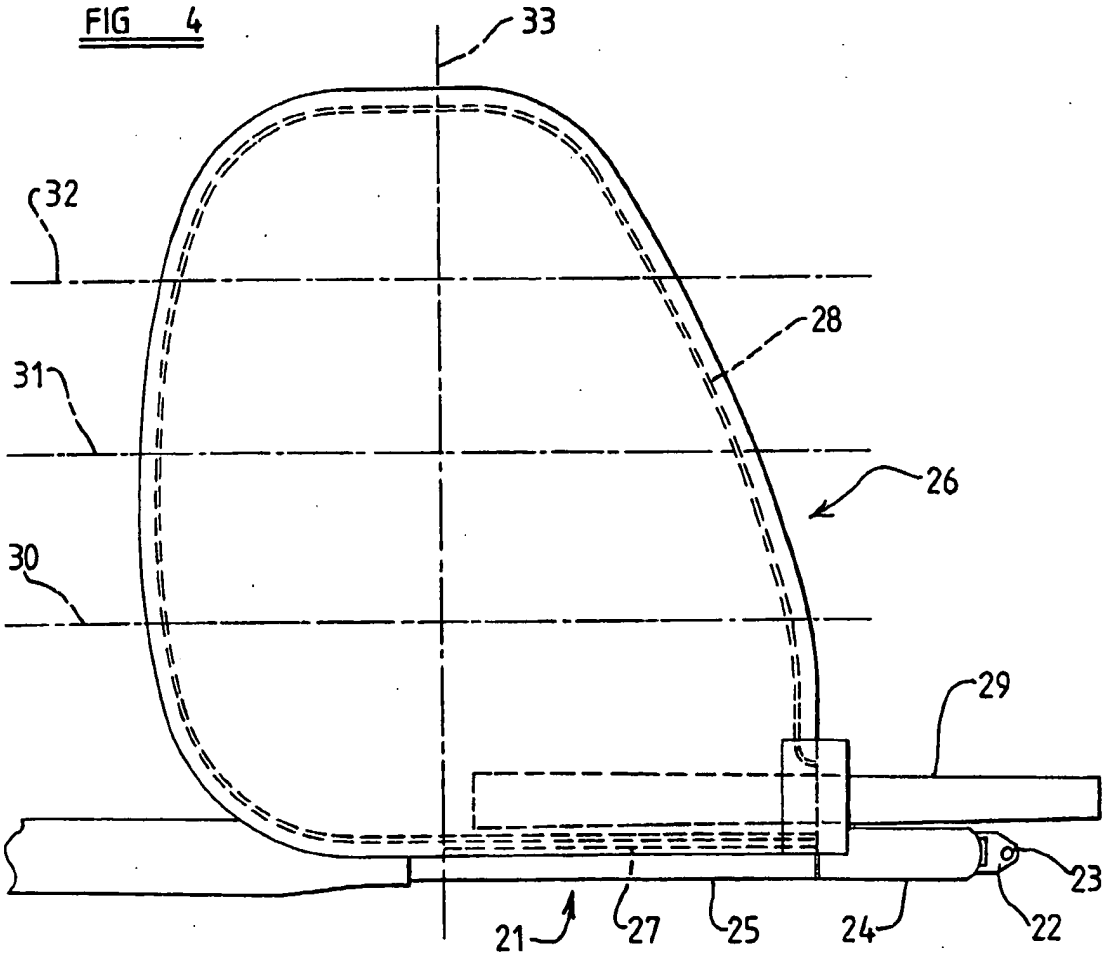


FIG 3

FIG 4



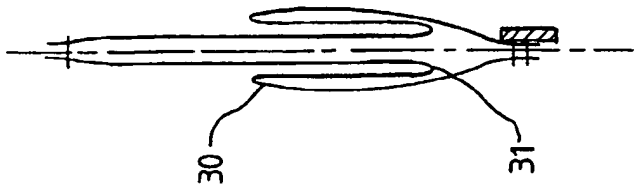


FIG 6

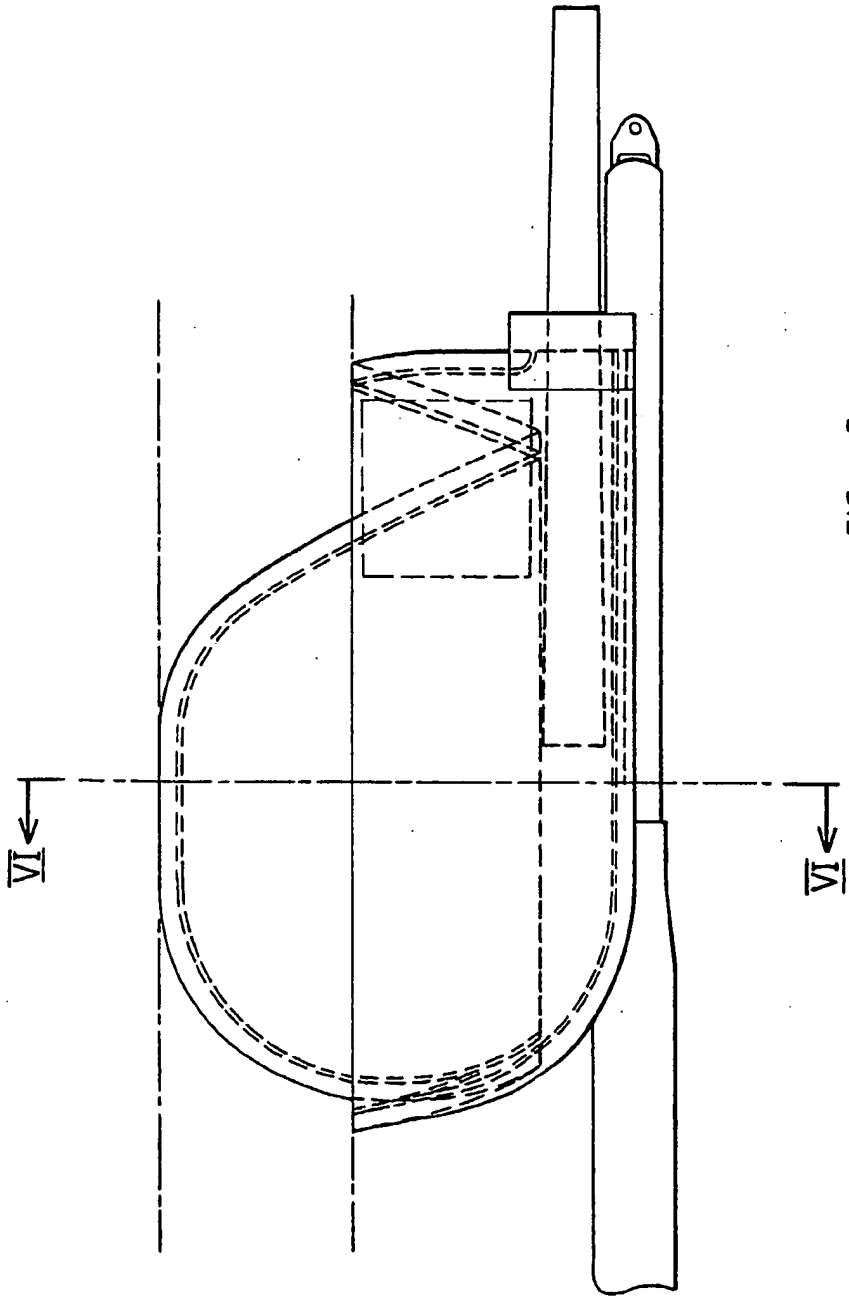


FIG 5

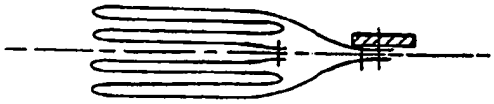


FIG 8

FIG 10

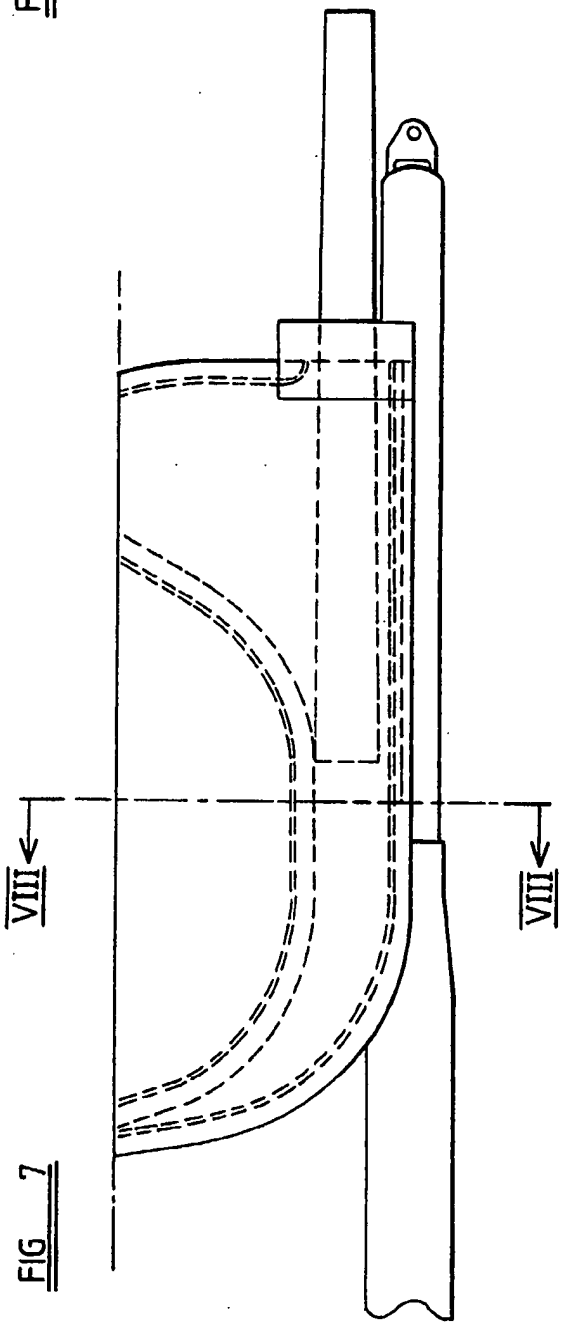


FIG 7

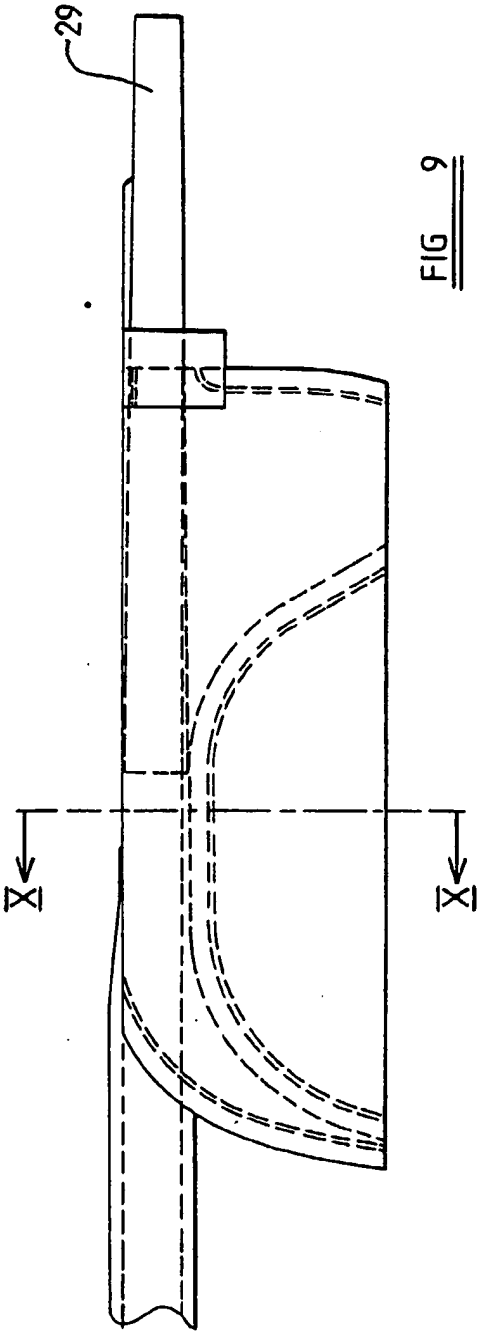


FIG 9

FIG 12

FIG 14

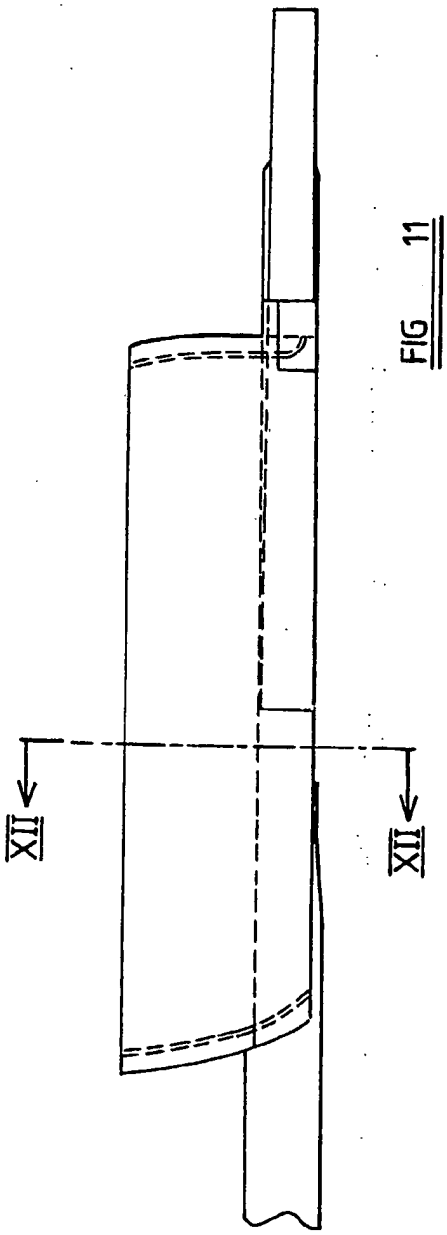


FIG 11

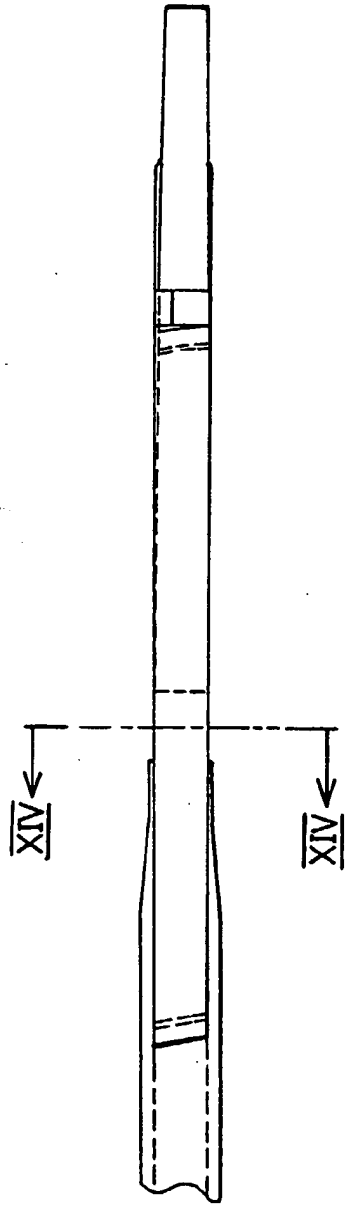


FIG 13

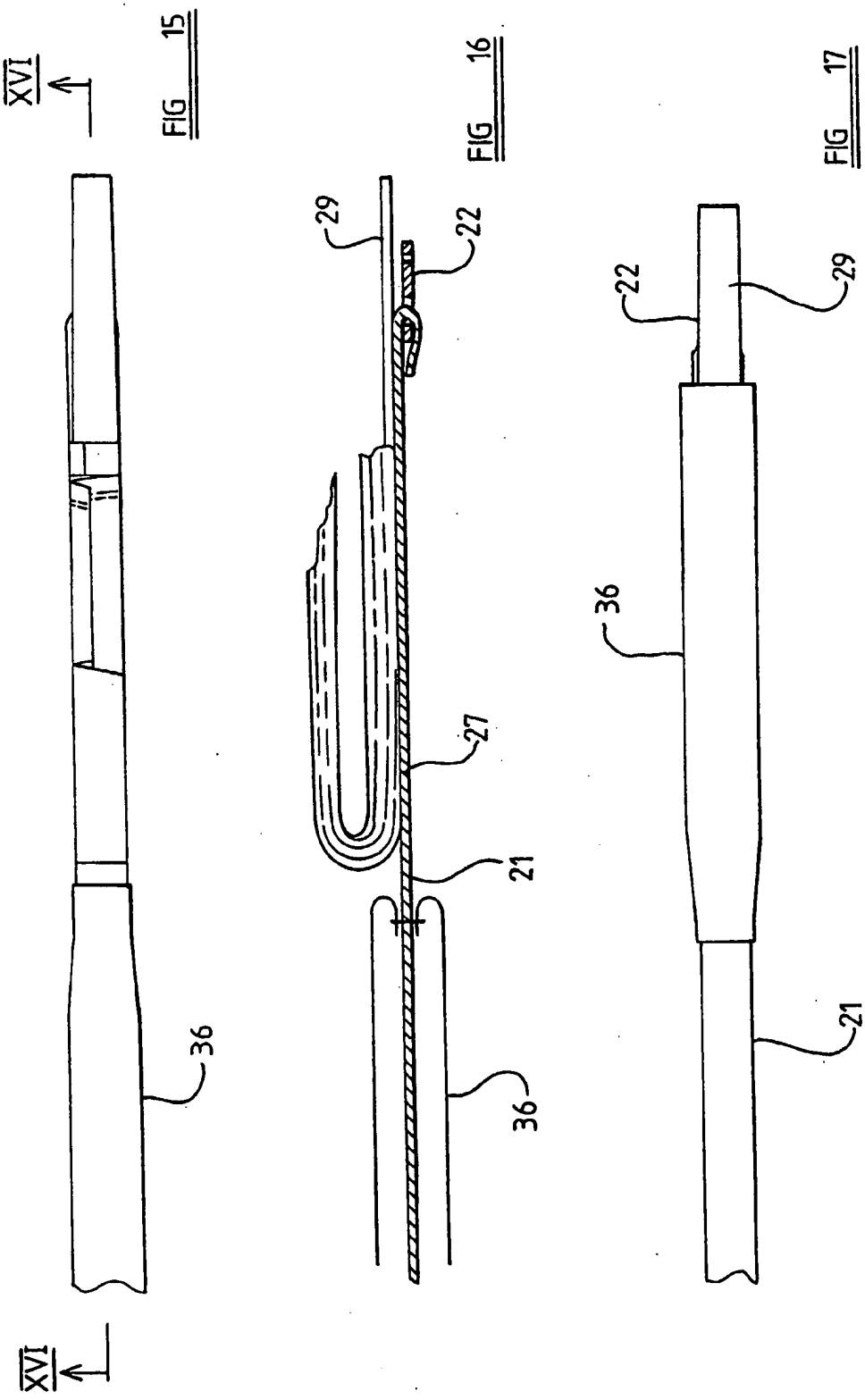


FIG 15

FIG 16

FIG 17

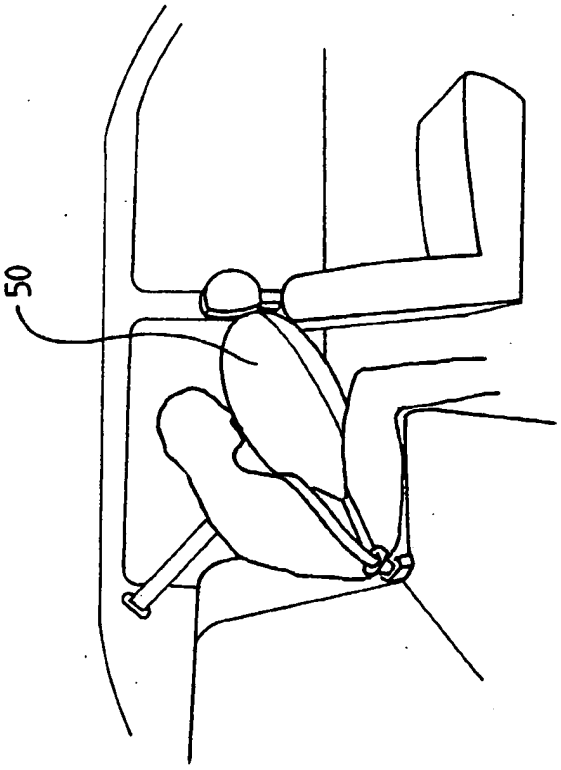


FIG 19

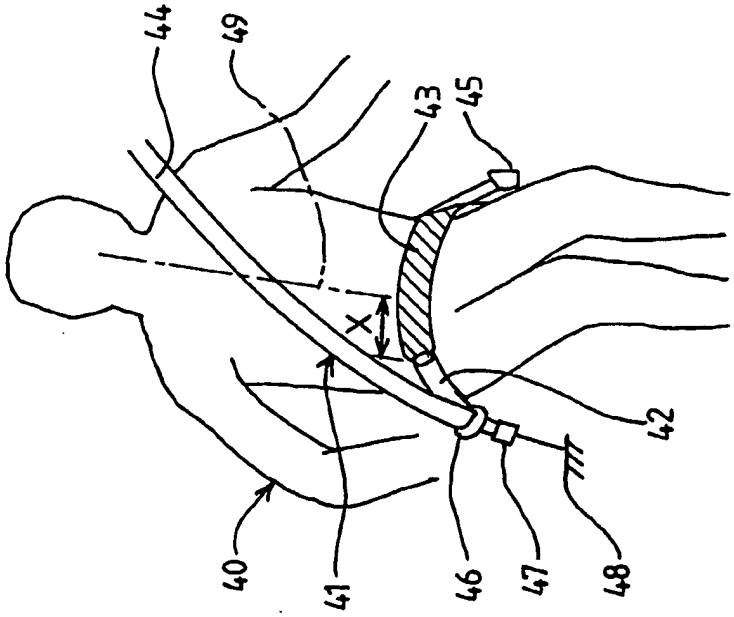


FIG 18

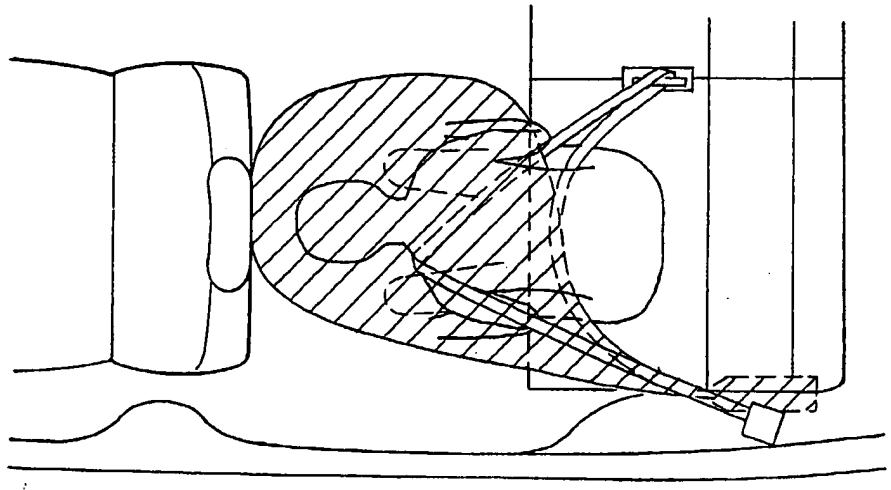


FIG 22

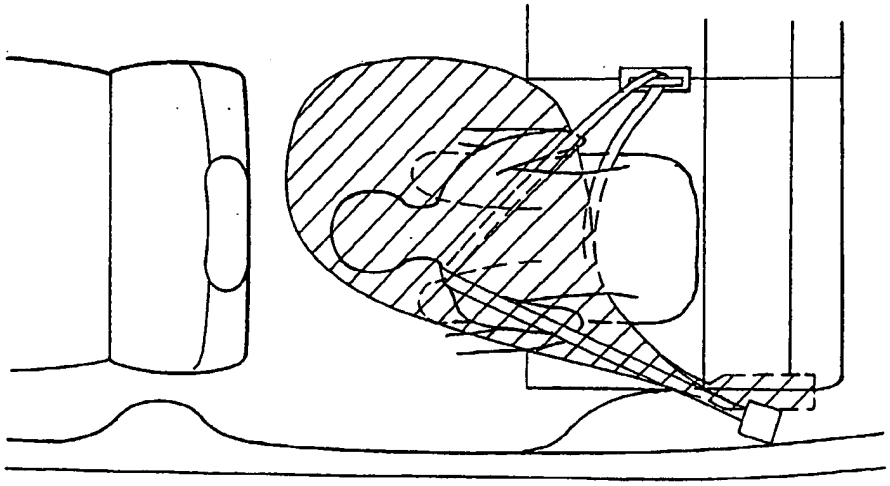


FIG 21

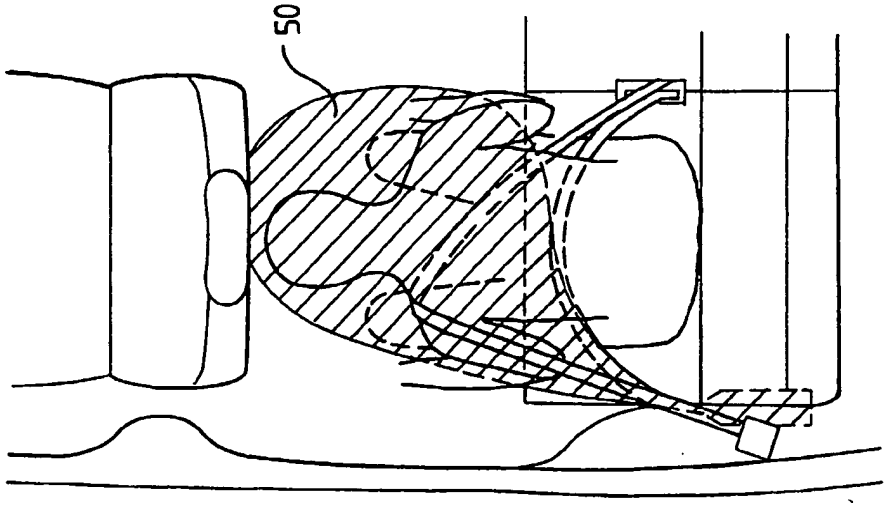


FIG 20

PATENTS ACT 1977

P13928GB-NF/jsd

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A SAFETY DEVICE"

THE PRESENT INVENTION relates to a safety device, and more particularly relates to a safety device for use in a motor vehicle such as a motor car.

It has been proposed previously to provide a safety device in the form of an inflatable element mounted on part of a safety-belt to be worn by an of a vehicle.

WO97/06983 shows an inflatable element incorporated into the lap strap of a three-point safety-belt, the inflatable element being in the form of a braided tube, the length of which decreases as the diameter increases on inflation thereof. The inflated tube serves to pretension the safety-belt, but the inflated tube restricts forward motion of an occupant of the seat, and serves to distribute crash loads over a relatively large pelvic area.

DE-19724191 shows an arrangement in which an air-bag is provided which, in the uninflated state, is located to one side of a seat of the occupant. The air-bag is provided with a plurality of rings which slide along a guide forming part of the safety-belt system. On inflation of the air-bag, the rings

extend along the guide and thus the air-bag becomes located generally in front of the occupant of the seat. Should, however, a ring "jam" or be unable to move along the guide, the inflated air-bag may be in an inappropriate position.

DE-19725558A shows a further arrangement in which a lap strap is formed to be inflatable. The inflated lap strap is located in front of the occupant of the seat.

A problem with an inflatable element mounted on a lap strap, as shown in WO97/06983 and DE-19725558A is that when the lap strap is manufactured, the size of the person to utilise the lap strap is not known. The lap strap may be used by a child or very small adult, and then the length of the lap strap actually used will only be slightly greater than the length of the lap strap than would extend from the conventional anchorage which anchors one end of the lap strap to the vehicle, and the buckle that receives a tongue provided on the lap strap. In such a case, it would be preferable for the inflatable part of the lap strap to be located directly in front of the child or young adult when the strap is in position. However, if the inflatable element is mounted on the lap strap in a position that is suitable for such a child or young adult, if the lap strap is utilised by a large adult, or even an obese adult, the inflatable part of the lap strap will then no longer be located in front of the person using the lap strap, but instead will be located to one side.

The present invention seeks to provide an improved safety arrangement.

According to this invention there is provided a safety device for a vehicle seat, the safety device incorporating at least a lap strap, one end of the lap strap being provided with means adapted to be fixed to an anchoring point provided on one side of the seat, the other end of the lap strap being provided

with means adapted to be releasable engaged with a buckle fixed to an anchoring point on the other side of the seat, the length of the lap strap being adjustable at the buckle side, there being a folded inflatable air-bag located on part of the lap strap, the air-bag being secured to the lap strap along that part of the lap strap on which the folded bag is located, the air-bag being such that, on inflation, part of the inflated bag will extend towards the said other end of the lap strap beyond the location of the bag when folded, the length and location of the folded air-bag being such that the folded air-bag will not engage the means to be releasably connected to the buckle, even when the lap strap is buckled, and extends substantially tightly across the seat without an occupant in the seat.

The safety belt may comprise solely the lap strap or may comprise a seat-belt of the so-called three-point-linkage variety, that is to say a seat-belt which incorporates the lap strap, and incorporates a further strap part which extends from the means adapted to be releasably connected to the buckle to a further point located above a shoulder of an occupant of the seat.

Preferably the part of the lap strap carrying the air-bag, and also the part of the lap strap extending between the part of the lap strap carrying the air-bag and the said one end of the hip-belt, is relatively torsion-stiff, the part of the lap strap extending from the folded bag to the means to be releasably engaged by the buckle being torsion-weak.

Advantageously the part of the lap strap that is torsion-stiff is provided with a reinforcing coating of a plastics material.

Conveniently the part of the lap strap that is torsion-stiff lies adjacent a gas duct lead to the air-bag, the gas duct providing at least part of the torsion-stiffness.

Preferably the distance between the part of the folded bag closest to the means to be releasably connected to the buckle, and the means to be releasably connected to the buckle, is at least one-quarter of the total length of the lap strap when the lap strap is buckled and extends substantially tightly across the seat without an occupant in the seat.

Advantageously the folded air-bag comprises an initially folded air-bag subjected to a final fold which folds part of the air-bag not fixed to the lap strap and extending towards the means adapted to be releasably connected to the buckle over the rest of the air-bag.

Conveniently the air-bag is constituted by two adjacent layers of fabric joined about their periphery, the initial folding process including the step of separating the two layers of fabric in a first region adjacent the lap strap and tucking part of the air-bag located further away from the lap strap, between the two separated layers.

Preferably the part of the air-bag furthest from the lap strap is tucked between the fabric layers of an intermediate region of the air-bag located between the first region and the said part of the air-bag.

Conveniently the initially folded bag is zig-zag folded so that the folded bag has a width substantially equal to the width of the lap strap.

Advantageously the folded air-bag has a length, measured along the lap strap, which is substantially equal to half of the length, measured in the direction of the lap strap of the unfolded, but inflated air-bag.

Conveniently the folded bag is covered by a flexible gaiter fixed to the lap strap.

Preferably the gaiter has one end thereof secured to the strap, the gaiter being in a position in which it embraces the lap strap and the folded air-bag.

Advantageously the size of the form of the air-bag is such that the air-bag, when inflated, will engage a rigid structure in front of the occupant of the seat within the vehicle.

Preferably the pressure inside the bag, when inflated, before the bag is hit by the occupant of the seat, is between 0.02 and 0.05 bar.

Conveniently the pressure is 0.03 bar.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic perspective view of a lap strap forming one embodiment of the invention,

FIGURE 2 is a diagrammatic view illustrating a three-point safety-belt incorporating an embodiment of the invention prior to use,

FIGURE 3 is a view generally corresponding to Figure 2 showing the three-point belt in use with a 95 percentile dummy,

FIGURE 4 is a plan view of part of the safety device of an embodiment of the invention at an early stage in the manufacture thereof.

FIGURE 5 is a view corresponding to Figure 4 during a subsequent stage of manufacture,

FIGURE 6 is a sectional view taken on the line VI-VI of Figure 6,

FIGURE 7 is a view corresponding to Figure 6 during the subsequent stage of manufacture,

FIGURE 8 is a sectional view taken on the line VIII-VIII of Figure 7,

FIGURE 9 is a view corresponding to Figure 7 at a later stage of manufacture,

FIGURE 10 is a sectional view taken on the line X-X of Figure 11,

FIGURE 11 is a view corresponding to Figure 9 showing a subsequent stage,

FIGURE 12 is a subsequent view taken on the line XII-XII of Figure 11,

FIGURE 13 is a view corresponding to Figure 11 showing a subsequent stage,

FIGURE 14 is a sectional view taken on the line XIV-XIV of Figure 13,

FIGURE 15 is a view corresponding to Figure 14 showing a subsequent stage,

FIGURE 16 is a sectional view taken on the line XIV-XIV of Figure 13,

FIGURE 17 is a view corresponding to Figure 13 showing a subsequent stage,

FIGURE 18 is a view corresponding to part of Figure 3 illustrating the safety device ready for use,

FIGURE 19 is a perspective view showing the safety device in use,

FIGURE 20 is a top plan view of the safety device in use as shown in Figure 18 and 19,

FIGURE 21 is a view corresponding to Figure 20 showing the device with an alternative size of dummy, and

FIGURE 22 is a top plan view corresponding to Figure 21 showing the device in sue when the vehicle is undergoing substantial deceleration.

Referring initially to Figure 1 of the accompanying drawings, one embodiment of the present invention comprises a safety device intended to provide protection for the occupant of a seat 1 in a motor vehicle. The safety device of this embodiment comprises a simple lap belt 2, one end of which is connected to an anchoring point 3 adjacent one end of the seat, and the other end of which is provided with an adjustable tongue 4 adapted to be received within a buckle 5 provided with anchoring means 6 to anchor the buckle 5 to

safety-belt 11 constitutes a diagonal strap which extends from the buckle 17 to the aperture 15 provided in the cover 14.

It is to be appreciated that in the embodiment of Figure 1 and in the embodiment of Figures 2 to 3, a lap strap is provided which carries a package which contains an inflatable air-bag.

Figure 4 illustrates a terminal part of a safety-belt 21. The safety-belt 21 may be used as the safety-belt 2 of the embodiment of Figure 1 or as the safety-belt 11 of the embodiment of Figures 2 and 3. The safety-belt 21 is provided, at the free end thereof, with a mounting plate 22. The mounting plate 22 is provided with an aperture 23 to receive a bolt or the like to enable the mounting plate 22 to be firmly secured to an anchoring point provided in a motor vehicle. Typically the anchoring point will be adjacent one side of a vehicle seat. The safety-belt 1 that is connected to the anchoring plate is of a conventional form, but a first terminal region 24 of the belt, and the next adjacent region 25, are provided with a reinforcement, in the form of a coating of a plastics material, which serves to make that part of the safety-belt relatively torsion-stiff. Thus, the plastics material coating is itself relatively rigid, thus minimising any risk that the terminal portion 24, or the next adjacent portion 25 of the safety-belt will be able to "twist". Thus the plastics coating will keep this part of the safety-belt substantially "flat".

An inflatable element, in the form of an air-bag 26, is provided, an edge portion 27 of which is secured to the region 25 of the safety-belt adjacent the terminal region 24. Thus the terminal region 24 is not provided with any additional items, and the next adjacent region 25 carries the inflatable element 26. The region 27 of the inflatable element that is secured to the region 25 of the strap 21 constitutes only part of the lower edge of the

inflatable element. Thus, the lower edge of the inflatable element extends, generally in alignment with the safety-belt 21, past the end of the stitching 27 which is remote from the anchoring plate 22. The inflatable element extends generally to one side of the safety-belt 21, with the inflatable element being substantially flat.

The inflatable element 26 is constituted by two super-imposed layers of fabric inter-connected by a peripheral seam 28. A gas duct 29 is provided which extends into the inflatable element 26. The gas duct 29 extends generally parallel with the safety-belt 21. The gas duct 29 is intended to be connected to a gas generator or inflator mounted on the vehicle at a point near the anchoring point on which the anchor plate 22 is mounted. The gas duct, being rigid, will add to the torsional stiffness of the belt 21 between the inflatable element 26 and the anchor plate 22.

Shown in Figure 4, for purposes of explanation, are three parallel chain lines 30, 31 and 32, which indicate where the inflatable element 26 will be folded during subsequent stages of the manufacture of the safety device, these parallel fold lines extending generally parallel with the axis of the safety-belt 21. A further chain line 33 indicates the line of a further subsequent fold, this chain only extending perpendicularly to the parallel fold lines 30, 31 and 32.

In an initial process stage, the two layers of fabric forming the inflatable element 26 are separated in a lower region thereof, and an intermediate part of the inflatable element is tucked downwardly into the lower-most region of the inflatable element. Thus, the air-bag is folded so that the part of the bag adjacent the fold-line 31 is moved downwardly, between the layers of fabric, until a situation is reached where the front and rear layers of fabric are each

folded in a re-entrant fashion at the fold-line 30, and are again folded back on themselves at the fold-line 31. Thus each layer of fabric is individually zig-zag folded. The portion of the inflatable element 26 identified by the fold-line 32 of Figure 4 is thus brought into alignment with the fold-line 30. This is the situation shown in Figures 5 and 6 of the accompanying drawings.

Subsequently the part of the inflatable element above the fold-line 32 of Figure 4 is itself tucked downwardly between the layers of fabric that extend between the fold-lines 31 and 32. This is the situation shown in Figures 7 and 8 of the accompanying drawings.

In a subsequent folding step, the entire inflatable element is folded so that the gas duct 29 overlies the safety-belt. This is the position shown in Figures 9 and 10. The inflatable element is now subjected as a complete entity, to zig-zag folding, with the spacing between adjacent folds being substantially equal to the width of the safety-belt 21. Thus, part of the inflatable element is folded to overlie the safety-belt and to extend again on the side of the safety-belt initially occupied by the inflatable element as shown in Figure 4. This is the position shown in Figure 11. Subsequently again part of the air-bag is folded back in the opposite direction, and the process is repeated until the air-bag is folded, with zig-zag folds, so that the entire air-bag overlies the safety-belt, as shown in Figures 13 and 14. As a final folding step, the part of the air-bag shown to the left of the fold-line 33 of Figure 4, that is to say the part of the air-bag beyond the end of the line of stitching 27 remote from the mounting plate 22, is folded back to overlie the rest of the folded air-bag, so that the entire folded bag overlies that part of the air-bag which is stitched, by stitching 27, to the safety-belt 21. This is the position shown in Figures 15 and 16.

A gaiter 36, which has an open end thereof secured to the safety-belt 21 at a point just beyond the end of the stitching 27 which secures the inflatable element to the safety-belt, and which is initially folded back to extend away from the inflatable element, is then drawn over the folded inflatable element to constitute a package containing the inflatable element. The gaiter 36 is made of a material adapted to break or rupture when subjected to a predetermined pressure.

As can be seen from Figure 17, the gaiter 36 covers the terminal region 24 and the next adjacent region 25 of the safety-belt 21 which are provided with the plastics material coating, so as to be relatively torsion-stiff. The gas duct 29 is located adjacent the connecting plate 22. The gas duct may be of a relatively stiff material, and the gas duct may be connected to a gas generator mounted in position close to the anchoring point adapted to co-operate with the mounting plate 22. Thus the presence of the rigid gas duct may serve to enhance the torsion-stiffness of the terminal region 24 of the safety-belt 21.

The part of the safety-belt 21 not covered by the gaiter 36 is not provided with any coating or the like to make that part of the safety-belt torsion-stiff, and thus this part of the safety-belt may be considered to be torsion-weak.

Figure 18 illustrates a safety device 40 comprising a safety-belt 41 which comprises a three-point belt having a lap strap 42, which carries a package 43 containing an inflatable element of the type discussed above, and also a diagonal strap 44.

the vehicle. Provided on the lap belt 2 is a package 7 which contains an inflatable element or air-bag. The air-bag 7 is connected by means of a gas duct (not shown) to an inflator or gas generator. The gas generator is adapted to be activated in response to a signal from a sensor adapted to sense a predetermined deceleration of the vehicle, or an impact of the vehicle. The nature of the air-bag will be described hereinafter.

Figure 2 illustrates an alternative embodiment of the invention. In this embodiment of the invention a three-point safety-belt is provided. Figure 2 illustrates a rear seat 10 in a motor vehicle. A safety-belt 11 is provided, one end of which is anchored by an anchoring plate 12 to part of the vehicle adjacent the vehicle seat. The other end of the safety-belt 11 is connected to a retractor mechanism 13 mounted in position adjacent the back of the seat 10. A cover 14 is provided to conceal the retractor mechanism, the cover 14 having an aperture 15 to guide part of the safety-belt 11 as it freely slides.

A tongue 16 is mounted on the safety-belt 11 adapted to be received within a buckle 17. The buckle 17 is provided with mounting means 18 to enable the buckle to be mounted in position securely adjacent the side of the seat opposite to the anchoring plate 12.

Part of the safety-belt 11 adjacent the anchoring plate 12 is provided with a package 19 which contains an inflatable air-bag, generally as described above with reference to Figure 1.

Figure 3 illustrates the safety-belt 11 of Figure 2 when in use. It can be seen that the part of the safety-belt 11 carrying the package 19 constitutes a lap strap 20 which extends from the anchorage 12 to the buckle 17. The rest of the

The lap strap extends between an anchorage 45 provided at one side of the seat, and a tongue 46 which co-operates with a buckle 47 which is connected to an anchoring point 48 provided at the other side of the seat. Typically the length of the lap strap 42 is between 500 and 700 millimetres, depending upon the size of the occupant of the seat. Of course, in extreme cases, the length of the lap strap may be less than 500 millimetres or more than 700 millimetres.

As shown in Figure 8 part of the package 43 containing the air-bag extends, by a distance "X" beyond a notional centre-line 49 of the occupant of the seat from the anchoring point 45. The distance X is 90 millimetres for a so-called 95 percentile dummy. A 95 percentile dummy is a dummy which is of such a size that 95% of the male population of the U.S.A. are of a smaller size. Thus the 95 percentile dummy corresponds to a relatively large man, with only a relatively small part of the population being larger. The distance X will typically be 140 millimetres for a 50th per cent isle dummy. A 50 percentile dummy has such a size that only 50 percentile of the male population of the U.S.A. are smaller.

The distance X will be 180 millimetres for a 5 percentile dummy. A 5 percentile dummy is such that only 5% of the male population of the U.S.A. are smaller.

It is to be appreciated, therefore, that the package 43 containing the inflatable element will extend beyond the mid point of an occupant of the seat in almost all cases, and also it is to be appreciated that the package does not extend as far as the tongue 46 connected to the buckle 47. Indeed, it is to be understood that the package 43 will not extend to the tongue 46 even if the safety-belt is secured and tightened with no occupant present in the seat. Thus

the distance at the end of the package 43 which is remote from the anchoring point 45 is less than the distance, as followed by the lap strap 42, from the anchoring point 41 to the tongue 46 when the seat is not occupied and the safety-belt is in position and tightened.

Turning now to Figures 19 and 20, it is to be appreciated that in the event that the sensor associated with the gas generator senses a deceleration in excess of a predetermined threshold or an impact, the gas generator is activated and gas will flow, through the gas duct, into the inflatable element within the package 43. The inflatable element will inflate to become an inflated cushion 50 located in front of the occupant of the seat. The inflated element, when viewed from above, is of substantially "drop"-shape.

The "drop"-shape inflated element has a relatively narrow portion located adjacent the end of the belt that is anchored to the motor vehicle, and has a relatively large bulbous portion which is spaced away from the end of the belt anchored to the vehicle and positioned to be located in front of the occupant of the seat. The size of the "drop"-shaped portion of the inflated element is such that as the occupant of the seat tends to bend forwardly, about the hips, in an accident situation, the head and torso of the occupant will impact with the bag.

Figure 20 shows that with a 95 percentile dummy, in an impact situation the main torso of the dummy is substantially aligned with the major area of the "drop"-shape inflated element.

The air-bag, when inflated, extends forwardly from the lap strap to occupy the space above the knees and in front of the thorax of the occupant of the seat. The air-bag has two critical dimensions. The first dimension is the

distance from the centre point on the lap strap measured forwardly in a direction parallel with the longitudinal axis of the vehicle to the forward-most part of the air-bag. The second dimension that is of importance is the greatest substantially vertical thickness of the inflated air-bag, that is to say the distance between the lower-most fabric and the upper-most layer of fabric measured in a vertical line.

It is important that the first dimension, for each size of occupant of the seat, is such that as the torso and head of the occupant move forwardly in an accident situation, the head and torso of the occupant impact with the bag, with no part of the head or torso "overhanging" the bag. Also, it is preferred that the second dimension should also be related to the size of the occupant. If the occupant is large, and thus heavy, the occupant should impact with a "thicker" air-bag as compared with a smaller occupant. If a small occupant impacts with a very "thick" air-bag, the desired degree of protection may not be provided.

Thus the air-bag 50, as shown in Figures 19 and 20, is configured so that the first dimension and the second dimension of the air-bag when it is in use, depend upon the size of the person using the air-bag.

In the situation shown in Figure 20, where the seat-belt is utilised with a 95 percentile dummy, a substantial length of the seat-belt constitutes the lap strap. Thus the mid point of the lap strap is a substantial distance from the fixed end of the lap strap. The first dimension of the bag in front of this mid point of the seat-belt is substantial, to accommodate the very large torso-and-head combination of the dummy when thrown forwardly. Also the part of the air-bag in front of the dummy has a substantial thickness, so as to accommodate the substantial weight of the torso and head of the dummy in an accident situation.

Figure 21 is a figure corresponding to Figure 20 showing a 50 percentile dummy in a moderate crash. It can be seen that in this arrangement the dummy impacts the main inflated area of the air-bag, but the main point of impact between the dummy and the air-bag is that part of the air-bag which is closest to the end of the lap strap that is secured to the anchoring point on the motor vehicle. Because, in the situation shown in Figure 21, the dummy utilised is smaller than the dummy of Figure 20, the length of lap strap in use is less. Thus the mid point of the lap strap, in the situation shown in Figure 21, is located closer to the fixed end of the lap strap. Consequently, as can be seen, the first dimension of the air-bag in the situation shown in Figure 1 is less than the first dimension of the air-bag in the situation shown in Figure 20 as discussed above. However, the dimension is sufficiently large to accommodate the torso and head of the dummy utilising the safety device. In the arrangement shown in Figure 21, the second dimension, or thickness of the inflated air-bag in front of the dummy is less than the thickness of the part of the inflated air-bag in front of the dummy in the situation shown in Figure 20. This is appropriate, since the dummy of Figure 21 will have a lower weight than the dummy of Figure 20.

As shown in Figure 22, if a 50 percentile dummy is involved in a very severe crash, in which there is substantial deceleration of the vehicle, the dummy may move forwardly relative to the seat, thus stretching the lap strap, and in this situation the dummy impacts the central region of the inflated part of the inflatable element.

It is to be observed that there is a part of the safety-belt forming the lap strap which extends from the region 25 which carries the inflatable element to the tongue or to the anchorage which retains that part of the lap strap. This part

of the lap strap is not reinforced in any way and is thus torsionally weak and is able to twist. If part of the lap strap is twisted in any way, the twist will always be located on this torsion-weak part of the lap strap. This will help ensure that the folded bag, retained by the torsionally stiff regions 24 and 25, will always be located on the side of the belt facing away from the occupant. The gas duct 29 will serve to increase the torsional stiffness of the region of the lap strap which carries the package containing the air-bag. The gas duct is provided at the end of the package closest to the anchoring plate 22, so that the gas duct may be connected to a gas generator which is mounted on the motor vehicle adjacent the anchorage to which the anchor plate 22 is connected.

It is preferred that the distance between the buckle and the end of the package containing the air-bag which is closest to the buckle, should be at least one-quarter of the total length of the lap strap between the buckle and the anchorage when the belt is buckled and stretched without there being an occupant on the seat. This helps to ensure that a reasonable number of twisting turns can be accommodated before the torsion-stiff part of the lap strap starts to twist.

It is preferred that the air-bag, as described above, should be inflated, before being hit by the occupant, to a pressure of between 0.02 and 0.05 bar, the most preferred pressure being 0.03 bar. A typical front air-bag in a motor vehicle, for example an air-bag mounted in the dashboard or in the steering-wheel, typically requires a pressure of 0.3 bar. This can make it very aggressive, especially when an occupant of the vehicle is in an out-of-position situation, thus being located very close to the air-bag when it begins to inflate. The described arrangement may be designed so that the air-bag is located in a desired position relative to the occupant, thus minimising the risk of injury to the occupant if the occupant is in an out-of-position situation. A much lower

pressure can be used which makes the air-bag of the embodiments described above much less aggressive than air-bags typically found in motor vehicles. It is possible that in preferred embodiments of the invention, the size and form of the air-bag is such that the air-bag, when inflated, engages part of the rigid structure of the vehicle located in front of the occupant such as, as shown in Figure 9, the back of the seat in front of the occupant being protected by the air-bag 50. In the case of a front seat occupant, the air-bag may be designed to engage the dashboard of the vehicle. The bag will thus effectively be supported from the front as well as being retained on the lap strap by the stitching described above.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A safety device for a vehicle seat, the safety device incorporating at least a lap strap, one end of the lap strap being provided with means adapted to be fixed to an anchoring point provided on one side of the seat, the other end of the lap strap being provided with means adapted to be releasable engaged with a buckle fixed to an anchoring point on the other side of the seat, the length of the lap strap being adjustable at the buckle side, there being a folded inflatable air-bag located on part of the lap strap, the air-bag being secured to the lap strap along that part of the lap strap on which the folded bag is located, the air-bag being such that, on inflation, part of the inflated bag will extend towards the said other end of the lap strap beyond the location of the bag when folded, the length and location of the folded air-bag being such that the folded air-bag will not engage the means to be releasably connected to the buckle, even when the lap strap is buckled, and extends substantially tightly across the seat without an occupant in the seat.

2. A device according to Claim 1 wherein the safety-belt comprises solely the lap strap.

3. A device according to Claim 1 wherein the seat-belt incorporates the lap strap, and incorporates a further strap part which extends from the means adapted to be releasably connected to the buckle to a further point located above a shoulder of an occupant of the seat.

4. A device according to any one of the preceding Claims wherein the part of the lap strap carrying the air-bag, and also the part of the lap strap extending

between the part of the lap strap carrying the air-bag and the said one end of the hip-belt, is relatively torsion-stiff, the part of the lap strap extending from the folded bag to the means to be releasably engaged by the buckle being torsion-weak.

5. A device according to Claim 4 wherein the part of the lap strap that is torsion-stiff is provided with a reinforcing coating of a plastics material.

6. A device according to Claim 3 or 4 wherein the part of the lap strap that is torsion-stiff lies adjacent a gas duct leading to the air-bag, the gas duct providing at least part of the torsion-stiffness.

7. A device according to any one of the preceding Claims wherein the distance between the part of the folded bag closest to the means to be releasably connected to the buckle, and the means to be releasably connected to the buckle, is at least one-quarter of the total length of the lap strap when the lap strap is buckled and extends substantially tightly across the seat without an occupant in the seat.

8. A device according to any one of the preceding Claims wherein the folded air-bag comprises an initially folded air-bag subjected to a final fold which folds part of the air-bag not fixed to the lap strap and initially extending towards the means adapted to be releasably connected to the buckle over the rest of the air-bag.

9. A device according to any one of the preceding Claims wherein the air-bag is constituted by two adjacent layers of fabric joined about their periphery, the initial folding process including the step of separating the two layers of

fabric in a first region adjacent the lap strap and tucking part of the air-bag located further away from the lap strap, between the two separated layers.

10. A device according to Claim 9 wherein the part of the air-bag furthest from the lap strap is tucked between the fabric layers of an intermediate region of the air-bag located between the first region and the said part of the air-bag.

11. A device according to any one of Claims 8 to 10 wherein the initially folded bag is zig-zag folded so that the folded bag has a width substantially equal to the width of the lap strap.

12. A device according to any one of the preceding Claims wherein the folded air-bag has a length, measured along the lap strap, which is substantially equal to half of the length, measured in the direction of the lap strap of the unfolded, but inflated air-bag.

13. A device according to any one of the preceding Claims wherein the folded bag is covered by a flexible gaiter fixed to the lap strap.

14. A device according to any one of the preceding Claims wherein the gaiter has one end thereof secured to the strap, the gaiter being in a position in which it embraces the lap strap and the folded air-bag.

15. A device according to any one of the preceding Claims wherein the size of the form of the air-bag is such that the air-bag, when inflated, will engage a rigid structure in front of the occupant of the seat within the vehicle.

16. A device according to any one of the preceding Claims wherein the pressure inside the bag, when inflated, before the bag is hit by the occupant of the seat, is between 0.02 and 0.05 bar.

17. A device according to Claim 16 wherein the pressure is 0.03 bar.

18. A safety device substantially as herein described with reference to and as shown in the accompanying drawings.

19. Any novel feature or combination of features disclosed herein.

Application No: GB 0025699.0
Claims searched: 1 - 17

Examiner: Peter Gardiner
Date of search: 6 February 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B7B: BSBCC, BSBCR, BVRA, BVRQ, BVRR

Int Cl (Ed.7): B60R: 21/18, 22/12, 22/28

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 98/55344 A1 PETRI AG (see figures 6 and 7 in particular)	1-3,7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.